

Applicant : Niall R. Lynam  
Page : 2

October 14, 1999, now issued as United States Patent No. 6,122,093, which is a continuation of prior pending application 09/233,164, filed January 18, 1999, now issued as United States Patent No. 5,986,797, which is a continuation of prior pending application Serial No.

08/939,854, filed September 29, 1997, now issued as United States Patent No. 5,864,419, which is a continuation of Serial No. 08/617,333, filed March 18, 1996, now issued as United States Patent No. 5,680,245, which is a continuation of prior pending application Serial No., 08/293,736, filed August 19, 1994, now United States Patent No. 5,523,877, which is a continuation of prior pending application Serial No. 08/082,882, filed June 25, 1993, now issued as United States Patent No. 5,355,245, which is a continuation of prior pending application Serial No. 07/732,572, filed July 18, 1991, now issued as United States Patent No. 5,239,406, which is a continuation-in-part of prior pending application Serial No. 07/464,888, filed January 16, 1990, now issued as United States Patent No. 5,115,346, which is a continuation-in-part of prior pending application Serial No. 07/155,256, filed February 12, 1988, now abandoned, the disclosures of all of which are hereby incorporated by reference herein.-

Page 22, lines 25-28:

Fig. 42 is a sectional view of a third embodiment of the scatter protected, anti-lacerative, ultraviolet radiation protected, laminate, electrochromic, near-infrared attenuated glazing assembly of the present invention;

Page 22, after line 28:

Applicant : Niall R. Lynam  
Page : 3

*a3*  
Please insert [Fig. 42A is a sectional view of a fourth embodiment of the scatter protected, anti-lacerative, ultraviolet radiation protected, laminate, electrochromic, near infrared attenuated glazing assembly of the present invention; and]

Page 67, lines 16-31:

*a4*  
A second embodiment 202 of the window glazing assembly invention is shown in Figure 40 where element 212 is the laminated composite formed from glass panels 251, 252. The specialized near-infrared reflector layer 250 is sandwiched between elements 251 and 252 on the inwardly facing surface of element 251. Thus, relative to the vehicle outside, layer 250 is below the electrochromic medium 220. Such a construction is less desirable than that shown in Figure 37 because layer 250 is not in a position to protect electrochromic medium 220 from the damaging effects of solar near-infrared and ultraviolet radiation.

Figure 36 shows the solar energy spectrum Air Mass 2 that constitutes the solar load incident on an automobile. The solar energy for Air Mass 2 is the insolation through two standard atmospheres using data originally proposed by P. Moon, Journal Franklin Inst., 230, 583 (1940). Most of the solar intensity for Air Mass 2 is between 300 and 2100 nm. On the average, ultraviolet (UV) constitutes 3% of solar radiation (up to 400 nm), while visible light or radiation is 48% (between 400 and 700 nm) and near-infrared (NIR) is 49% (between 700 and 2100). If a perfect filter-

*a5*  
Page 68, lines 4-27:

[As a specific illustration of the benefit achievable through use of a specialized near infrared reflector in combination with an electrochromic medium, UV,

Applicant : Niall R. Lynam  
Page : 4

luminous and solar transmission studies were performed on both an electrochromic cell alone and on the combination of commercially available heat mirror constructions with the same electrochromic cell. The cell was formed by sandwiching an electrochemichromic solution comprising:

*as const*

0.035 M	ethylviologen perchlorate
0.035 M	5,10-dihydro-5, 10-dimethylphenazine
5% wt/vol	UVINUL™ 400 (2, 4-dihydroxy-benzophenone)

dissolved in a solvent comprising 75% 3-hydroxypropionitrile and 25% glutaronitrile. The cell gap was 135 microns. The ITO transparent conductors sandwiching the electrochemichromic medium were of half-wave (about 1500 angstroms) thickness and of sheet resistance 15 ohms/square or thereabouts coated onto 0.043" thick lime glass elements. Measurements were taken over four spectral ranges, namely, ultraviolet (UV), visible, near-infrared (NIR), and solar (Air Mass 2), of the attenuating characteristics of this electrochromic cell construction, both when the cell was bleached and when it was colored under 1 volt applied potential. The results are summarized in Table A.

*a6*  
Page 73, lines 1-5:

*a6*  
indium oxide thin film layers, all in turn deposited onto a thin MYLAR™ flexible polymer film. Table C summarizes the results obtained when the electrochemichromic window cell of Table A was combined with a HM-55 heat mirror film by application to the outer glass surface.

Applicant : Niall R. Lynam  
Page : 5

Page 75, line 1-18:

EZ-KOOL™ glass which is a green tinted glass of increased cerium oxide and iron oxide content, available from Libbey Owens Ford of Toledo, Ohio, or with equivalent specialized UV-absorbing glasses as described above in connection with the electrochromic mirrors. Such specialized UV-absorbing glasses have a higher iron oxide content of within the range of about 0.2% to 0.9% by weight and/or a higher cerium oxide content of 0.2% to 0.9% by weight. Even higher iron oxide and/or cerium oxide contents, such as 1% to 2% or more, can be contemplated, for applications such as sunroofs, etc., where the dark tinting that accompanies such high levels of iron oxide and/or cerium oxide may not be product objectionable. For specialized UV absorbing glasses that have a high iron oxide content, it is desirable to maximize UV absorption by maximizing the ferric (Fe III) ion content of the glass. Alternately, a specialized UV absorbing glass of titanium dioxide content greater than 0.2 weight percent or thereabouts can be used.

Page 78, lines 1-30:

Element 216 consists of panels 251, 252. Panel 252 is a blue-tinted, UV-absorbing specialized glass (3 mm thickness) available from Ford Glass Company, Detroit, Michigan, under the trademark SUNGLAS™ BLUE. Layers 257a and 257b are blue-tinted plasticized polyvinylbutyral sheeting, each of sheet thickness 0.030", available from E.I. duPont de Nemours and Company of Wilmington, Delaware, under the trade name BUTACITE™ Cobalt Blue B140 0547800. Layer 250 is a specialized near-infrared reflector available from Southwall Corporation of Palo Alto, California, under the trade name HM-55 film. Element 212 and panel 251 were coated on their respective surfaces 213 and 217 with a transparent

Applicant : Niall R. Lynam  
Page : 6

conducting layer of full-wave indium tin oxide (ITO) of thickness approximately 3000 angstroms and of 7 ohms/square or thereabouts sheet resistance. The interpane gap 218 between elements 212 and 216 was about 135 microns in thickness. The electrochromic medium 220 was an electrochemichromic solution comprising:

a8 cont  

0.035 M	ethylviologen perchlorate
0.035 M	5, 10-dihydro-5, 10-dimethylphenazine
5% wt/vol	UVINUL™ 400 (2, 4-dihydroxy-benzophenone)

dissolved in a solvent comprising 75% by volume 3-hydroxypropionitrile and 25% glutaronitrile. Coloration was achieved by applying 1 volt potential across the electrochromic medium 220. Antilacerative layer 214 is a two-layer composite comprising an inner tear-resistant sheet 214a of plasticized polyvinylbutyral and an outer abrasion resistant layer 214b of polyester, and is marketed under the trademark BE 1028 by E.I. duPont, Wilmington,

Delaware.

Page 79, lines 1-20:

A9  
Layer 214 can also include silicone moieties chemically incorporated in the anti-lacerative composite to prevent condensation and/or beading up of condensed water on the coated front surface 211 of element 212, in high humidity conditions thereby providing an anti-fogging, anti-misting result. A material found useful as anti-lacerative, anti-fogging layer is silicone impregnated polyurethane layer 214' of sunroof/glazing embodiment 206' shown in Fig. 42A. Layer 214' is supplied under the trade name CLARIFLEX™ by Saint-Gobain Vitrage of Paris, France. UV reducing additives such as those described in

Applicant : Niall R. Lynam  
Page : 7

connection with Fig. 2 may also be incorporated in the anti-lacerative, anti-fogging layer to increase the lifetime of the assembly. Alternately, element 212 may be fashioned from conventional soda lime glass, UV reducing specialized glasses, or polymer plastics. It is also possible to utilize thin film coatings or UV reducing paints or lacquers on at least one surface of front element 212 when the anti-lacerative, anti-fogging layer is incorporated. Likewise, it is possible to apply a near-infrared reflector incorporating a thin elemental metal film to front surface 211 of element 212.

Page 82, lines 1-31:

chemicals used in electrochromic medium 220. Likewise, and particularly for applications such as a sunroof, sun visor, or shade band where sun glare reduction, good shading efficiency, and good thermal insulation performance is desirable, at least one of elements 212, 216, 251 and 252 can be formed from architectural glass such as SOLARBRONZE™, a bronze tinted glass; SOLARGRAY™, a gray tinted glass; GRAYLITE™, a dark gray tinted glass; and SOLEX™, a green tinted glass; all available from Pittsburgh Plate Glass Industries of Pittsburgh, Pennsylvania; SUNGLAS™ Gray, a gray tinted glass; and SUNGLAS™ bronze, a bronze tinted glass; available from Ford Glass Company, Detroit, Michigan; and with E-Z-EYE™, a green tinted glass; available from Libby Owens Ford of Toledo, Ohio. Further, elements 212, 216, 251 and 252 can be coated with low-emittance monolithic architectural coatings such as SUNGATE™ 100, a low emittance, high transmittance coating available from Pittsburgh Plate Glass Industries of Pittsburgh, Pennsylvania; and SUNGLAS™ HR, a low emittance, high transmittance coating available from Ford Glass Company, Detroit, Michigan. Also, ECLIPSE™, pyrolytic Low-E coating available from

Applicant : Niall R. Lynam  
Page : 8

Libby Owens Ford of Toledo, Ohio can be used. Further, elements 212, 216, 251 and 252 can be coated with vacuum deposited architectural coatings such as SOLARBAN™ available from Pittsburgh Plate Glass Industries of Pittsburgh, Pennsylvania, or can be coated with KOOLOF™, a solar control coating available from Libby Owens Ford of Toledo, Ohio.

*All Coated*  
Further, perimetric or perimeter coatings and darkened/color matched seals, as described in United States Patent No. 5,066,112, entitled-

Page 83, lines 1-24:

*All*  
**P**ERIMETER COATED, ELECTRO-OPTIC MIRROR, invented by Niall R. Lynam, the disclosure of which is hereby incorporated by reference herein, can be applied to window glazing constructions such as shown in Figs. 37, 40 and 43. For example, perimetric or perimeter coatings, 310 and 311 of Fig. 43, of a conductive black frit or paint, can be applied around the perimeter of surface layers 312a and 217a so as to hide from view the seal 229 and the connection of electrical leads 22, 24 to layers 213a, 217a. A suitable material is ENGLEHARD SC 6002 (# 6082), a platinum/palladium conductive ink available from Englehard Corporation of Iselin, New Jersey. Also, seal 229 can be color matched to any bezels, gaskets, encapsulants, or vehicular body moldings used to fix the electrochromic window assembly into a vehicle. For example, carbon black, in a nonconducting form, could be added to seal 229 in order to render it color matched to any black or dark rubber or plastic encapsulation means used to secure the electrochromic assembly into the vehicle.

Alternately, perimetric or perimeter coatings 410, 420, as shown by the dashed lines on Fig. 43, and formed from, for example, a frit material such as DRAKENFELD™ black enamel 24-